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LIGHTING DATA

EDISON LAMP WORKS
OF GENERAL ELECTRIC COMPANY

GENERAL SALES OFFICES

HARRISON, N. J.

Lighting

Artificial Daylight for Merchandising and Industry



Information compiled by

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Lighting Service Department

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For information regarding MAZDA lamps and lighting questions, refer to the nearest sales office as listed on the last page of this bulletin.

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STUTTGART, GERMANY

ALFRED B. J. J.

Artificial Daylight for Merchandising and Industry

*Information Compiled by G. H. Steckney
Lighting Service Department*

Introductory

In view of the lack of a general understanding of the features of lighting for the purpose of inspection or selection of colored materials, it seems desirable to present a general review of the subject.

For ordinary purposes the color of artificial light is not highly important so long as it is pleasing and does not depart too far from that of daylight. In fact, a yellow tone in light is often desirable, on account of artistically pleasing qualities. On the other hand, there are certain applications in connection with the manufacture, inspection and sale of colored materials where it is highly important that they be viewed under an illumination that is much closer to daylight in color than is the illumination from ordinary lamps.

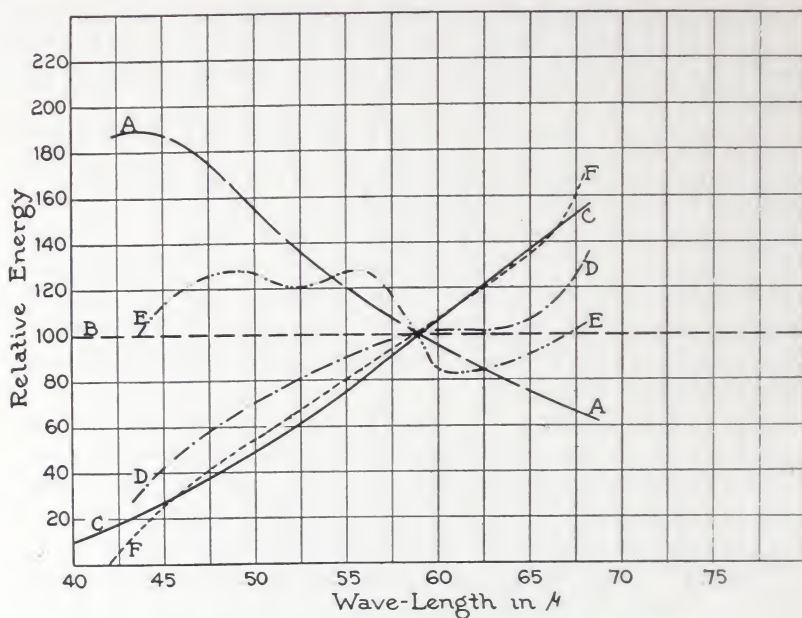
Since the appearance of colored objects varies more or less with the color of the light falling on them, it is important, especially for artistic articles which are seen under daylight, that color determinations and selections be made under a light of daylight quality. This is especially the case with garments in which different materials, such as woolen cloth, silk linings, braids and buttons, are combined, as the apparent colors are not always affected similarly or in the same degree by a change of light. In such a case, parts which harmonize under one light may clash under another. It should be noted also in this connection, when such articles are likely to receive their principal use in the evening, that the colors should be inspected under the predominating artificial light.

Color of Natural Light

Although daylight is universal, and almost as intimately experienced as gravity, few realize how complex it is in its composition, nor the extent to which it is subject to variation in intensity and color.

Light emitted by the sun traverses the 92,000,000 miles of space with practically no apparent color change. However, on entering the earth's atmosphere it becomes modified. Small particles of water, vapor, clouds and dust in the atmosphere, tend to deduct, especially the short waves or blue rays, from the direct

sunlight. Part of this light is scattered and received as skylight. So that we receive a combination of direct filtered sunlight and skylight. It is evident, therefore, that the character of daylight, as we know it, depends to some extent upon the state of cloudi-



Spectrophotometric Curves of Typical Color Modifying Glass
(Energy Intensity for Various Wave Lengths)

- A-Blue Sky
- B-Average Daylight (Black Body at 5000°K)
- C-Mazda lamp at 19 lumens per watt (Black Body at 2850°K)
- D-Daylight Mazda Lamp
- E-Accurate color matching type unit
- F-Typical daylight enclosing globe

FIG. 1

Spectrographic Curves of Typical Color Matching Glass

ness, the angle at which sunlight enters the atmosphere, etc. In interior lighting other factors enter; for example, the position of the sun with reference to the window exposure, and the color of nearby buildings which may be reflecting light into a room. Fortunately some of these factors tend to compensate for each other, and the variation is usually less than might be expected.

While the variation of daylight colors is sufficiently large to render accurate determinations difficult, it must be remembered

that they are small compared with the difference between average daylight and unmodified light of practically all artificial illuminants.

For accurate color matching purposes, experts have always preferred the light from the north sky—i. e., that from which direct sunlight is always absent. The apparent advantage of this is that it is subject to less variation than any other natural light. Such light contains more blue than average daylight, and undoubtedly the latter would have been preferred if it were obtainable as a fixed standard. Artificial lighting can be and has been produced which is more accurate as a color standard, but such lighting is expensive and therefore practicable only where the value of the accuracy is great or the areas to be lighted small.

Demands for White Light

Observations of the practical use of daylight lead to the conclusion that there is a wide range of demands as to accuracy of color matching. That the silk dyer needs an accurate standard is evidenced by the pains taken, even at considerable expense, to work always under unobstructed north light.

The woolen industry apparently has a slightly less exacting demand, and the cotton industry less yet, although compared with most industries these (i. e., textile manufacturing), along with the manufacture of celluloid, ivory, and a few other things, may be classed in a separate group with exacting demands.

Nearly all other color industries find daylight from any direction acceptable, and very few take pains to eliminate colored light reflected from buildings. These fall in a second grade as to color accuracy.

When we come to the sale of all these goods, we find a much lower standard of accuracy acceptable. Many of the finest dry-goods stores are in the business centers, where the surrounding buildings must necessarily modify the light to a considerable extent and subject it to variation through the more or less direct reflection of sunlight from adjacent structures. Still further is the light modified by window shades and hangings, as well as wall finishes, mahogany furniture and other woodwork. So that it is evident that store managers have not recognized any such demand for color accuracy as have the manufacturers. Thus, a third grade is formed.

In artificial lighting, the production of daylight color is usually secured at the expense of efficiency, the sacrifice depending upon

the degree of accuracy required. There is, therefore, a demand for several compromises, depending upon the relative importance given to these two elements, viz., cost of light and color accuracy.

Since there is today a relatively small demand for a highly accurate light and a much larger demand for a more efficient light, even though less accurate, it is evident that ordinary demands can readily be taken care of by the modified light from the incan-

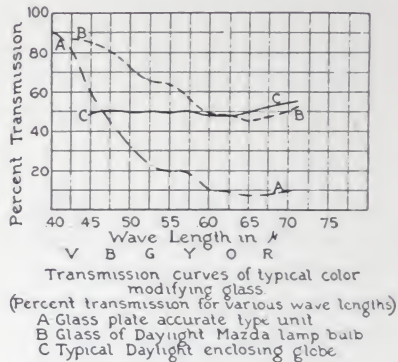


FIG 2
Transmission Curves of Typical Color Matching Glass

descent lamp, especially since the MAZDA C lamp has made a much whiter light source available. Particularly for the general lighting of large interiors, such as salesrooms, efficiency and attractive appearance, as well as color accuracy, are of great importance, and the more accurate unit used for localized lighting of small areas will not so adequately meet the requirements.

Method of Modifying Artificial Light

In modifying the light of an illuminant for color matching purposes, the best method at present available is that of passing the light through glass so colored as to absorb part of those radiations which are in excess, so as to produce approximately the same balance of light rays as exists in daylight. This means that the intensity and therefore the efficiency is reduced. While a considerable modification can be made with relatively little loss, further correction involves much larger sacrifices. It is no simple matter to produce glass suitable for this purpose, since ordinary glasses absorb too much of one color and not enough of another.

It is not so difficult to produce a light which appears white or displays a few colors correctly. This does not seem to be understood by many who are manufacturing and selling glass for this purpose, so that it is necessary to use considerable discretion in the selection of color screens. The only safe method of determining the correctness of the glass filter is to supplement careful spectrophotometric tests by the practical demonstration of the light on a large number of colored samples selected throughout the range of colors.



FIG. 3

Accurate Color Matching Units for Industrial Purposes. Light from a MAZDA C lamp is reflected downward through a glass color screen. The unit on the right, of the angle type, produces high illumination on vertical surfaces.

Accurate Color Matching Units

There are two or three makes of color matching units which employ MAZDA C lamps with colored glass screens very accurately chosen to modify the light in such a manner to produce a mean between north skylight and average daylight. Such a unit is relatively expensive and inefficient, but this form has proven satisfactory where the most exacting color requirements are encountered. In general, these accurate color matching units consist of a metal reflector arranged to concentrate the light downward through a blue green glass filter plate. They are available in sizes from 150 to 500-watt. Such fixtures are ordinarily employed to light a table top, or an area of 6 to 8 sq. ft. on which colored material is inspected. They have been employed in commercial dye-houses, for cotton grading, color printing, paint and ink mixing, and many other industrial purposes. They have also been used in lighting color booths in silk and dress goods departments of drygoods stores, haberdasheries and tailor shops. As a rule such units are not sufficiently economical for general

lighting of stores. Some of the fixtures are so designed that either artificial daylight or ordinary incandescent lighting can be obtained by the mere throw of a switch, enabling the goods to be examined under both conditions of use.

The Daylight Mazda Lamp

As before pointed out, there is a very large demand for a more efficient, although less accurate degree, of color modification. This is obtained with the Daylight MAZDA lamp. This lamp is provided with a scientifically determined blue glass bulb, while the filament is run at a higher temperature, giving a whiter light than produced by the regular MAZDA C lamp. Daylight MAZDA lamps are made in sizes from 75 to 500-watt, and, while the efficiencies of the various sizes are slightly different, they correspond approximately to those of the larger MAZDA B lamps. The lamps, therefore, are applicable to general lighting.

As pointed out in the bulletin on the effect of color of walls and ceilings on resultant illumination where Daylight MAZDA lamps are used in semi-indirect or other ornamental glassware, it is important that the glass and reflecting surfaces, such as the walls and ceilings, be white, yellow tinted glass or room finish tend to counteract the effect of the blue bulb, thereby lessening the special advantage of the light for color purposes.

In the case of the Daylight MAZDA lamp, in spite of the popular opinion to the contrary, the blue bulb does not add anything to the color of the light, but on the other hand subtracts a certain percentage of the rays which are predominant in the unmodified light. It is evident from this that the efficiency of the Daylight MAZDA lamp is necessarily lower than that of the regular MAZDA C lamp. This fact must always be borne in mind when installing Daylight MAZDA lamps, since it will be necessary to use approximately 35 per cent more wattage than when clear bulb MAZDA C lamps are installed to obtain the same illumination.

Color Modifying Globes

Besides the units already described, there is on the market a considerable variety of enclosing glassware sold for color matching purposes. Some of these equipments have considerable merit. The majority have little advantage beyond an apparent whitening of the light. Some, however, while having a considerable absorption, actually lessen the color matching value of the light of the

MAZDA C lamp. Unfortunately, there are manufacturers of such glassware who claim in their advertising "perfect color matching effect." Such claims tend to discredit all such publicity and injure other similar products which have considerable merit.

This situation is ameliorated, however, by the fact that many merchants who think they desire color matching illumination really are better off with a light of yellowish tint which has the advantage of producing a more cheerful appearance in the store.

In conclusion, it may be noted that, while there seems to be a general impression that an exact duplication of daylight color is needed in lighting, there is in reality a wide diversity of requirements, relatively few of which include a high degree of accuracy. Even where colored materials are handled and sold, the common illuminants without color modification meet the large majority of cases.

Specific Applications of Modified Light

Stores.—Daylight MAZDA lamps find a wide field of application in store lighting. This type of illuminant will never supplant the regular MAZDA C lamp for general illumination; for the public, as a whole, prefer the somewhat warmer hue of the latter, as it makes the store look cheerful and inviting. Prominent merchants have stated that, in over 90 per cent of their sales, color matching is not an element. They feel it desirable to sell goods under the conditions most favorable to their best appearance. Many of the finest garments will be worn at night and are designed to be most attractive under average night illumination such as furnished by the regular MAZDA lamps. Nevertheless, there are certain goods which should be lighted with a nearer approach to daylight than furnished with clear bulb lamps. In this class fall those clothes which would be worn largely out of doors.

Daylight MAZDA lamps used for general store illumination give a distinctive appearance to the store which has a distinct advertising value. In fact, some stores so lighted make it a feature in their newspaper and other advertising calling attention to the "Daylight" store. Even though Daylight MAZDA lamps are not used for general illumination throughout, there are certain departments which will require such a light to display the goods to the best advantage, for example, men's clothing (particularly blues and blacks), linens, which appear pure white rather than slightly yellowish, furs, jewelry, silks and shoes.

Many of the most progressive stores in the country have supplemented the general illumination with the accurate type of color matching units over the counters and in other parts of the store where color matching is an important element. Larger types of these same units are employed over the triplicate mirrors in the clothing department with very satisfactory results.



FIG. 4

A Counter Type Color Identification Unit Showing the Application in Merchandising Greatly Simplifying the Selection of Colored Materials

These units provide local lighting of the high intensity suitable for the critical examination of colored fabrics. It is not necessary to enclose such devices in a booth for the amount of light directly beneath the fixture is so much greater than the illumination necessary for the store as a whole that the mixture of color of light does not affect the result. Where accurate color comparison units are installed the customer can have absolute confidence in his judgment. These save a great deal of the clerks' and customers' time by avoiding the necessity of carrying merchandise to the doorway or window for inspection, and are a decided economy in store operation.

Show Windows.—Daylight MAZDA lamps in the show windows cause them to stand out prominently in comparison with other

forms of illumination. While they are not necessary as standard show window equipment, every store of any appreciable size should have a complete set for at least one window, so that when displays requiring such a quality of light are in place they may be employed.



FIG. 5

A Color Identification Unit Placed Above the Triplicate Mirror in a Clothing Establishment. Confidence in purchasing garments is much greater when artificial daylight is available

Laundries.—Spots and stains on goods are usually of a brownish or yellowish tint. If the light source is rich in yellow, then these blemishes tend to fade into the white background and are hard to detect. Daylight MAZDA lamps in steam laundries over the folding and inspection tables enable the operator to catch many an improperly cleaned piece and thus keep up the standard quality of the work.

Textile Mills.—Without doubt, most of the processes here are carried on without regard to color. After the warp is made up and the shuttles filled with thread of the proper color, operations proceed almost automatically, but there is the liability of the mixing of color which may throw out an entire piece. Daylight

MAZDA lamps are being installed over looms in a number of instances to avoid this difficulty. It must be borne in mind that the color of light produced by these lamps is not accurate enough for color matching as the term is used in the dye-house, and the more accurate units should be recommended for such work. Color matching devices are also very desirable in the final inspection departments, bleacheries and show-rooms.

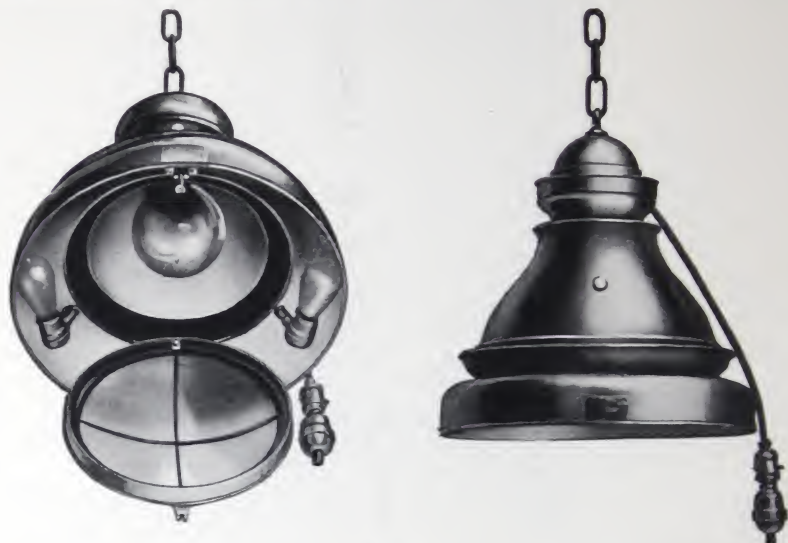


FIG. 6

A Color Identification Unit in Which a Large MAZDA C Lamp Housed in the Center Produces Accurate Color Matching Light After Passing Through a Large Circular Color Screen at the Bottom. Small MAZDA B lamps at either side provide a convenient means of comparing artificial lighting color effects with daylight

Concentrating Plants.—Iron and zinc streaks must be recognized as they are found on the concentrating tables. The zinc is of a rusty gray color and the iron of rusty red brown color. In a mill lighted by ordinary types of lamps it is difficult to tell these colors apart, yet it is necessary to separate most of the iron ore from the zinc. Some of the mines in the West have installed Daylight MAZDA lamps for localized lighting over the tables for this purpose.

Chemical Laboratories and Sugar Refineries.—Daylight MAZDA lamps have given quite satisfactory service in illuminating the centrifugal machines in use in the laboratory. They assist in the

discriminations of color necessary for the grading and matching of cane sugar. Some prominent chemical manufacturers are employing Daylight MAZDA lamps for watching changes of color in their testing departments, particularly in connection with titrating. There are also numerous places about the chemical plant where very definite demands for constant north sky color quality exist, and with the devices mentioned this can be satisfactorily met.

Photographic Supplies.—Some manufacturers of photographic materials are employing Daylight MAZDA lamps for examining the quality and color of prints; correct shades of blues, blacks and sepias can be determined far more readily with this type of illuminant. Daylight MAZDA lamps are also used for microscopic and low power photomicrography and in connection with the spectrograph for determining color sensitiveness of photographic emulsions. Where a high degree of accuracy is required the accurate type of color modifying device is essential.

Printing.—It is quite difficult to detect the yellow half-tone from the white background when illuminated by regular MAZDA lamps, and other colors are not shown in their true relation. Some of the large lithographing companies are using Daylight MAZDA lamps to light the receiving end of the presses and also in the proof room and artist's workshop. The accurate type of color matching units, however, are particularly adaptable to the final inspection and for the absolute assurance of satisfactory night work. By the proper use of modified light, overcast and short days put no check on the art or press work in the lithographing plant.

Cigar Factories.—Cigars are graded according to shade, and minor differences in color must be detected in inspecting and sorting. The Daylight MAZDA lamp assists in this work. A high quality of product can be obtained in the factory lighted with these lamps. This factor alone offsets the slight additional cost of operation.

Miscellaneous Industries.—Other fields in which modified light has proven useful are oil refineries, where it is necessary to determine the difference between grades of oil; in fruit packing houses, where oranges and lemons are sorted according to color as well as to size; in paper mills, where the sample room is so illuminated; in the jewelry trade, for the critical examination of stones such as diamonds and pearls; in metal working, for the selection of brass

by color; and in miscellaneous places about flour mills, rubber goods and garment factories, button factories, potteries, paint factories, etc.

Medical.—The Daylight MAZDA lamp has proven quite a boon to the medical profession, in the chemical laboratories and assisting in microscopic examination. For diagnosis of skin disease and retina examinations, prominent specialists have employed this form of illuminant. In the operating room, the various tissues are revealed more accurately when examined under a light of the Daylight lamp—as, for example, when operating on a jaundiced patient whose tissues are yellow and whose blood gives all the tissues of the body a yellow tint, a yellow light would be unsatisfactory. During operations for gall stones, yellow bile ducts, red arteries and blue veins must be distinguished one from the other.

One of the first uses for which the Daylight MAZDA lamp were placed was the examination of x-ray negatives. A suitable light for this purpose is necessary, for, after the plate is developed, it is necessary to inspect this very carefully to determine the ailment or discover the fracture. The negative is in general illuminated by very diffused light from the rear, and experience has proven that the whiter the light the greater the ease of the examination. Diffused light for this purpose is obtained by using what is practically indirect illumination. A box or frame to hold the negatives is painted flat white on the interior surface. Lamps are concealed from view and equipped with reflectors to direct the light on this white background. From here it is reflected to an opalescent ground glass plate covering the opening or mouth of the box.

In dental work the Daylight MAZDA lamps used for general illumination of the office or in the concentrating spot lamp assist materially in detecting decayed spots and diseased conditions. Many accurate color matching units are used by the dental supply companies for the matching, grading and sorting of artificial teeth.

Art Galleries and Museums.—Daylight MAZDA lamps are used in many instances with splendid results for illuminating paintings. The artist paints his pictures under natural light; he places the colors on his canvas with particular relation to each other. Each small area of the picture is blended with the next and viewed as a whole. If the color of light is such as to materially modify the relation between these various areas of the picture, then his object is defeated. Portions may be intensified; others dulled. The better the painting the greater the demand for suitable lighting. Many

of the art exhibits throughout the country are visited at night by the general public, and for this reason the question of the correct artificial illumination is of much importance.

Hotels.—The field of application of Daylight MAZDA lamps is far broader than one can imagine and it would be out of the question to attempt to enumerate all the various applications for which they find use in the hotel. If the sample room is fitted with Daylight MAZDA lamps, then the critical examination of goods on display is facilitated. In the linen department they enable the help to detect spots on table cloths and napkins readily. Over the cigar counter they present the display in more nearly its true value.

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EDISON LAMP WORKS OF GENERAL ELECTRIC COMPANY

GENERAL SALES OFFICE, *HARRISON, N J

SALES OFFICE (address nearest office)

*ATLANTA, GA	Third National Bank Building
BALTIMORE, MD	Lexington Street Building
BIRMINGHAM, ALA	Brown-Marx Building
*BOSTON, MASS	84 State Street
BUFFALO, N Y	Electric Building
BUTTE, MONT	Electric Building
CHARLESTON, W VA	Charleston National Bank Building
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JOHIN, MO	Miners' Bank Building
*KANSAS CITY, MO	Dwight Building
KNOXVILLE, TENN	Burwell Building
*LOS ANGELES, CAL	Corporation Building, 724 S Spring Street
LOUISVILLE, KY	Starks Building
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MILWAUKEE, WIS	Public Service Building
*MINNEAPOLIS, MINN	410 Third Avenue North
NASHVILLE, TENN	Stahlman Building
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*NEW ORLEANS, LA	Maison Blanche Building
*NEW YORK, N Y	Equitable Building, 120 Broadway
NIAGARA FALLS, N Y	Gluck Building
OMAHA, NEB	Electric Building
*PHILADELPHIA, PA	Witherspoon Building
*PITTSBURGH, PA	Oliver Building
*PORTLAND, ORE	Electric Building
PROVIDENCE, R I	Turks Head Building
RICHMOND, VA	Virginia Railway and Power Building
ROCHESTER, N Y	Granite Building
*SALT LAKE CITY, UTAH	Newhouse Building
*SAN FRANCISCO, CAL	Rialto Building
SCHENECTADY, N Y	G E Works
SEATTLE, WASH	Colman Building
SPokane, WASH	Paulsen Building
SPRINGFIELD, MASS	Massachusetts Mutual Building
*ST LOUIS, MO	Pierce Building
SYRACUSE, N Y	Onondaga County Savings Bank Building
TOLEDO, OHIO	Spitzer Building
WASHINGTON, D C	Commercial National Bank Building
YOUNGSTOWN, OHIO	Stambaugh Building
*For Texas, Oklahoma and Arizona business refer to:	
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*Stock of lamps at these points

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